

ON A COLLECTION OF *BOMBUS* AND *PSITHYRUS* PRINCIPALLY FROM SUTHERLAND, WITH NOTES ON THE NOMENCLATURE OR STATUS OF THREE SPECIES (HYMENOPTERA, APOIDEA)

D. B. BAKER

Hope Entomological Collections, University Museum, Oxford OX1 3PW.

INTRODUCTION

A small collection of *Bombus* and *Psithyrus* was made by the present author and Mrs M. W. Baker at Inchnadamph, Sutherland, between 29 September and 2 October 1964. The majority of the specimens were collected from *Centaurea* on meadowland near the SE corner of Loch Assynt (grid ref. NC 253218) [abbreviated below to Inchnadamph A] and along the path following the stream, Allt Poll an Droighinn, running down from Beinn Uidhe, at an altitude of c. 500–1250 ft [Inchnadamph B]. A few specimens were collected in the Inchnadamph National Nature Reserve (where it had been intended to collect, but where few plants were still in flower), in Gleann Dubh, c. 750 ft (NC 276205) [Inchnadamph C]. For specimens collected elsewhere, full data are given. Despite the late date, 79 specimens representing seven species were taken. It was noted that workers of several species of *Bombus* remained active until well after sunset in spite of the cold: Freuchen & Salomonsen (1959: 193) record that in the Arctic, in June, *Bombus* species, which here fly even in rain and fog, 'fly the twenty-four hours of the day, although about midnight the number diminishes for a few hours' (see for more detailed observations on arctic *Bombus*, and further references, Friese, 1908).

The opportunity has been taken of recording also the *Bombus* and *Psithyrus* taken by the late C.H. Jowett, Esq., and Miss P.H. Jowett on Mull and Iona in 1962 and 1963. These records are enclosed in square brackets.

SPECIES TREATMENTS

Bombus (Megabombus) hortorum (L., 1761)

Material: Sutherland, Inchnadamph (A), 30.ix.1964, 1♂; 1.x.1964, 1♂.

[Mull, Ross of Mull: Uisken, 2.ix.1962, at mallow, 3♂; Uisken, 2 miles S. of Bunessan, 14.ix.1962, 1♂ (all C.H. & P.H. Jowett); Uisken, 10.ix.1963, 3♂ 1♀ (C.H. Jowett); Ardfenaig, 2 miles W. of Bunessan, 10.ix.1962, 2♂ (C.H. & P.H. Jowett); Ardfenaig, 5.ix.1963, 2♂ (C.H. Jowett). Iona, 5.ix.1963, at *Centaurea nigra* L., 1♂ (C.H. Jowett).]

Bombus (Thoracobombus) pascuorum septentrionalis Vogt, 1909

Apis pascuorum Scop. 1763: 306; Carniolia [for the locality see Baker, 1994: 289, note (1) under Scopoli].

Apis agrorum F., 1787: 301; [♀]; in Europae. Junior primary homonym of *Apis agrorum* Schrank, 1781.

Bombus agrorum f. *septentrionalis* Vogt, 1909: 64, 75; Nordwest schottland. No type designated: proposed for a form of unspecified status ('In der Färbung steht dieser Gruppe ['*frey-gessneriformen*' of *agrorum*] nahe: *septentrionalis* m. Wie *valesianus* . . .').

Bombus agrorum [Rasse] *septentrionalis* Krüger, 1958: 338.

Material: Sutherland, Inchnadamph (A), 29.ix.1964, 1♂ ♂; 30.ix.1964, 1♂ ♀; 1.x.1964, 2♂ ♂; 2.x.1964, ♀.

[Mull: Ross of Mull, Uisken, 2.ix.1962, at mallow, 4♂ 1♀; Uisken, 2 miles S. of Bunessan, 14.ix.1962, 1♂ (all C.H. & P.H. Jowett); Uisken, 10.ix.1963, 1♂ ♂ (C.H. Jowett); Kintra, 1.5 miles N.W. of Fionnphort, 10.ix.1962, 1♂ (C.H. & P.H. Jowett); Kintra, 6.ix.1963, on *Centaurea nigra* L., 2♂ 1♀ (C.H. Jowett); Ardfenaig, 2 miles W. of Bunessan, 10.ix.1962, ♀ (C.H. & P.H. Jowett).]

Bombus (Thoracobombus) ruderarius ruderarius (Müller, 1776)

Material: [Mull, Ross of Mull, Uisken, 10.ix.1963, 1♀ (C.H. Jowett). Iona, 5.ix.1963, at *Centaurea nigra* L., 11♂ (C.H. Jowett).]

Bombus (Thoracobombus) laevis sladeni (Vogt, 1911)

Bombus muscorum auctt. nec (L.) [The lectotype of *Apis muscorum* L., designated by Day (1979: 68), belongs to the species variously known under such names as *cognatus* Steph. (Saunders, 1884), *venustus* Smith (Saunders, 1896), *solstitialis* Panz. (Richards, 1927), *variabilis* Schmiedeknecht (1930), *humilis* Ill. (Bischoff & Hedicke, 1931), or *helferanus* Seidl (Pittioni, 1939). It is regrettable that Løken (1973: 146), although 19th century Scandinavian authors had correctly identified Linnaeus's species, elected to follow the misapplication of Linnaeus's name.]

Bombus muscorum f. *laevis* Vogt, 1909: 63; Kleinasien.

Bombus smithianus 'var., or race,' *pallidus* Evans, 1901: 47; ♂; [Scotland:] 'taken by myself near Kingussie (Inverness-shire), Aberfoyle (S. W. Perthshire), and Elvanfoot (Lanarkshire), and also specimens from the Perth district, Dumbartonshire and Kirkcudbrightshire, kindly sent me by Messrs. Rodger, Malloch, and Service'. Invalid junior homonym of *Bombus pallidus* Cresson, 1863 [= *Bombus (Fervidobombus) pennsylvanicus* (Degeer, 1773)].

Lectotype, by present designation, ♂, labelled 'Elvanfoot/18.9.00' (endorsed '*Bombus/smithianus* ♂', the '*smithianus*' overwritten on '*venustus*') and 'W. Evans RSM/1971.55' [print], in Department of Natural History, National Museums of Scotland. Paralectotypes, in same collection: 11 ♂♂, Scotland: Lanarkshire, Elvanfoot, 5.ix.1900 (3), 11.ix.1900 (1), 12.ix.1900 (2), 18.ix.1900 (1), ix.1900 (3) (all W. Evans); Dumbartonshire, Bonhill, 15.ix.1900 (J. R. Malloch); Kirkcudbrightshire, Southernness, viii.1895 (R. Service).

Agrobombus muscorum . . . var. geogr. nov. *sladeni* Vogt, 1911:52; sex?; Südengland.

Bombus muscorum celticus Yarrow, 1978: 15; *nom.nov.* for '*Bombus muscorum pallidus* Evans (*Bombus smithianus* var. *pallidus* Evans, 1901)'. Yarrow failed to designate a lectotype for Evans's taxon. Since *celticus* was proposed as a replacement name, it has no independent type.

Nomenclature: The name *laevis* was proposed by Vogt for a form of unspecified status¹ from Anatolia: 'An *Muscorum*formen finden wir in Kleinasien einen ganz kurzhaarigen Vertreter *laevis* m.: wie *muscorum* gefärbt = *typicus*, die Orangefarbe des Thorax auf einen runden Fleck beschränkt—ab. *laesoides* m.'. The taxon was later recognized by Richards (1935a: 79) as a subspecies of what he also knew as *muscorum*. That the nominotypical subspecies is not identical with the presumed *Stammform* is perhaps unfortunate, but by no means an uncommon accident of nomenclature.

Bombus laevis exists in two groups of colour-forms, of erratic distribution, treated as species by some authors. Dark forms have been referred to '*smithianus*' [*smithianus*

auctt. nec White]², pale to 'muscorum' [*muscorum auctt. nec* (L.)]. There are, however, no significant structural differences between the two groups, and no apparent ecological or biological differences. Both groups are represented in the British Isles, each by several forms now treated as subspecies of *laevis*. The names *allenellus*, *scyllonius* and *liepetterseni* (the last a misapplication)³ have been applied to dark forms occurring on islands off the British and Irish coasts, the names (*pallidus* =) *celticus*, *sladeni* and *orcadensis* to pale forms inhabiting the British and Irish mainlands and (*orcadensis*) the Orkneys.

The name *pallidus* was proposed by Evans for 'the variety having the hairs on the underside of the body, and on the legs, pale yellow instead of black'. Evans's description must be taken as referring exclusively to the male because, although he had material of both sexes, he was unable to distinguish the queens and workers from his 'venustus' (pale forms of *muscorum* and ? *pascuorum*): 'Besides these males I have females and workers from the same and other localities, which I cannot but regard as belonging to the same form, though the absence of any known structural differences between ♀ and ♂ of *Smithianus* and those of *venustus* precludes . . . absolute certainty of identification'. Dr M. R. Shaw sent for examination the series from Evans's collection standing as *pallidus* in the National Museums of Scotland. The series comprises 14 males, of which two are without data and are not accepted as syntypes, 8 queens and 6 workers. A lectotype has been selected as noted above and 11 other males labelled as paralectotypes: since Evans did not identify any queens or workers as definitely belonging to *pallidus*, it would seem illogical to recognize any queen or worker *pallidus* in his series as syntypes.

The name *sladeni* was proposed by Vogt for a variety with the 'Behaarung deutlich struppiger als die des *typicus*, weniger struppig als die von *pallidus*. Färbung die des *typicus*, aber Thoraxdorsum vorne und hinten ausgesprochen hellgelb behaart (Annäherung an die Färbung *fulvofasciatus* Friese meines *muscorum laevis*)'.

Richards (1935a: 77) noted that *pallidus* (*celticus*) was doubtfully distinct from *sladeni*, and *celticus* and *sladeni* appear in fact to represent a north-south cline in coat and colour characters: the British mainland and Irish mainland *laevis* should be known as *sladeni*. The occurrence of *Bombus laevis sladeni* has been linked with marshy and similar habitats, but this is by no means always so: at Seaford, Sussex, for example, *sladeni* occurs on chalk downland in association with, among others, the deceptively similar *muscorum anglicus* [*Bombus humilis anglicus* Yarrow, 1978].

A summary of the British and Irish forms of *laevis* is given at Appendix 1.

Material: Sutherland: Inchnadamph (A), 29.ix.1964, 1♀ 1♂; 30.ix.1964, 2♂ 2♀; 1.x.1964, 2♀.

[Mull, Ross of Mull, Uisken, 2.ix.1962, at mallow, 2♂ 1♀; Uisken, 2 miles S. of Bunessan, 14.ix.1962, 1♀ (all C.H. & P.H. Jowett).]

Bombus (*Kallobombus*) *cardui cardui* (Müller, 1776)

Apis cardui Müller, 1776: 165; no locality specified [Denmark or Norway].

Apis soroensis F., [1777]: 246; Habitat in Daniae nemoribus. Lectotype ♀, Denmark: Sjaelland, designated by Løken (1966: 200).

Nomenclature: *Apis cardui* was described by Müller in the following terms: '1929. *Ap. Cardui* hirsuta nigra, ano albo. * + ' (signature a4: '. . . signo + a me, detectae indicantur').

Von Dalla Torre (1896: 549) gave *cardui* as a junior synonym of *soroensis*, but Müller's work (title page dated 1776, preface dated 31 March 1776, addenda

dated 18 June 1776) appeared before Fabricius's (title page not dated, preface dated 26 December 1776). The Scottish and Fennoscandian *cardui* belong to the nominotypical, white-tailed, form of the species. To be more exact, both Müller's ('hirsuta nigra, ano albo') and Fabricius's ('*Apis hirsuta atra, ano albo . . . tota atra, solo ano nigro*': lectotype designated by Løken, 1966) descriptions chanced to be based on the same melanic, white-tailed variant, although the ranges of both the N. W. European white-tailed⁴ and the more widely distributed red-tailed (*proteus* Gerstäcker, 1869) subspecies of *cardui* overlap in Denmark with the presence of all grades of intermediates as well as melanic forms (Løken, 1973: 32).

Material: Sutherland, Inchnadamph: (A), 30.ix.1964, 2♂; 1.x.1964, 1♀; (B), 1.x.1964, 1♀.

[Mull, Ross of Mull: Uisken, 2.ix.1962, at mallow, 1♂; Uisken, 2 miles S. of Bunessan, 14.ix.1962, 1♀ (both C.H. & P.H. Jowett); Uisken, 10.ix.1963, 3♀; Kintra, 6.ix.1963, at *Centaurea nigra* L., 2♂ (all C.H. Jowett); Kintra, 1.5 miles N.W. Fionnphort, 10.ix.1962, 2♀ (C.H. & P.H. Jowett).]

Bombus (Bombus) magnus (Vogt, 1911)

Terrestribombus lucorum f. *magnus* Vogt, 1911: 56; ♀ Nordschottland und . . . Orkneyinseln.

Nomenclature: Saunders (1884; 244; 1896: 378) recognized, under the name *terrestris* L., but a single species of *Bombus* s. str. in Britain, and treated '*lucorum* Smith' as a colour variety. Subsequently, two species of *Bombus* s. str. were generally recognized in Britain, *B. audax* Harris, 1780 [= *terrestris* *auctt.*], represented by its nominotypical form⁵, and *B. terrestris* (L., 1758, *nec auctt.*) (= *B. lucorum* (L., 1761)), also represented by its nominotypical form. More recently a third form, *B. magnus* Vogt, 1911, described from Britain, has been recognized as of specific rank by various authors, e.g., Krüger (1951–58, *passim*, but especially 1954: 264) and Løken (1973: 46), and this ranking is accepted here. *B. magnus* appears to be, in N. W. Europe, a relict form existing in populations peripheral to those of the more or less ubiquitous *terrestris*, and although a majority of recent British records, especially those from southern Britain, based on unreliable coat-colour characters, are suspect, the identity of the present series is unambiguous. *B. magnus* was 'described' by Vogt in the following terms: 'Das ♀ des *Tb. [Terrestribombus] lucorum* ist in Nordschottland und auf den Orkneyinseln so gross wie das von *Tb. terrestris* [i.e., *audax*] (forma nova *magnus*)'. To this meagre description subsequent authors have added various details, but the distinctions alleged have not been wholly convincing (Elfvig, 1960: 31, was unable to separate Finnish *magnus* from (*lucorum*=) *terrestris* in the presence of material determined by Kruseman) and even those made by Løken (1973: 14, key, couplet 11 and fig. 13A 14) are not entirely satisfactory⁶. However, in N. W. Scotland, where *audax* does not occur, *magnus* is distinguishable from *terrestris* by its larger size, by, in the queen, the colour pattern and especially the pinkish-yellow colour of the tail, and, in the male, by the genitalia.

While the character may not be a practical one for routine determinations, differences in the endophalli of *magnus*, *terrestris* and *audax* confirm specific ranking of *magnus* (C. O'Toole: personal communication).

Material: Sutherland, Inchnadamph: (A), 29.ix.1964, 4♂; 30.ix.1964, 2♂ 1♀; 1.x.1964, 3♂ 2♀; (B), 1.x.1964, 1♂ 2♀ 1♀; Inchnadamph, without exact locality, 29.ix–2.x.1964, 6♂ 3♀ (not now held).

The genitalia of 12 of the males were extracted and the lengths of the gonocoxites measured, taking the reference points indicated by Richards (1927: fig. 61). To ensure that the results would be strictly comparable with those published by Richards (1927: 249), control measurements of series of *audax* and *terrestris* from southern England were made. The results indicated a population intermediate between the *audax* and *terrestris* populations sampled by Richards (Fig. 1).

It is noteworthy that, as the figure indicates, in the series examined and in the series recorded by Richards there was no overlap between large examples of *terrestris* and small examples of *audax*, that the difference between the means for *terrestris* and *audax* was substantial; and that the mean value for the admittedly small sample of *magnus* ($n=12$) fell approximately midway between the mean values for the other species and between the upper limit for *terrestris* and the lower limit for *audax*. The data on which Fig. 1 is based are given in Table 1.

It may be noted that, for the samples measured in connection with the present paper, SD and CV for widely separated populations of *audax* (Iran, N.W. Europe) were quasi-identical, SD 0.0408, 0.0424, CV 1.9, 1.96; for *terrestris* (all populations) were 0.0489, 2.49; and for *magnus* were 0.0941, 4.6, indicating a higher degree of variability in that species—or in that population. A larger sample of the Inchnadamph population would be desirable, but no alien component appears to be present in the present one, which, apart from some variation in the colour of the clypeal hairs, appears homogeneous. Mayr (1969: 170) notes that zones of secondary intergradation between subspecies are often characterized by a greatly increased CV; and, of course, the boundaries, or areas of overlap, between a relict species surviving in populations peripheral to those of an invasive or usurping species (here the nearly ubiquitous *terrestris*), are likely to be shifting ones.

Among the characters that have conventionally been used to separate males of *audax* and *terrestris* is the colour of the hairs of the clypeus, vertex, mesosomal episterna and pseudosternum, and first metasomal tergum. In *audax* these hairs are usually black, in *terrestris* yellow. In the present series, of five specimens with gonocoxites falling within the range of variation of *terrestris*, three have the coloration of *audax* while the other two are nearer *audax* than *terrestris*; and, of six falling within the range of variation of *audax*, the two largest, nearest the mean for *audax*, are those most resembling *terrestris* (hairs of the indicated areas predominantly pale, although still darker than in that species). This reversal suggests that coat pattern in the *terrestris* complex is an unreliable distinguishing character.

As to any correlation between size and coat pattern of colour, the present small sample is inconclusive. Taking gonocoxite length as a measure of size, and the colour of the clypeal hairs as an index of the extent of pale coloration, no strong correlation is evident, although there is an apparent tendency for smaller specimens to be darker:

Gonocoxite length (mm)

1.93 1.93 1.93 1.98 2.01 2.01 2.05 2.09 2.13 2.13 2.13 2.21

Colour of clypeal hair (b: black, pb: predominantly black, m: mixed, pp: predominantly pale)

b m b b m m m m pb m pp pp

Of the 3 queens, two have the tail pinkish-buff and the thoracic collar extending well onto the mesepisterna, characters generally regarded as characteristic of *magnus*. The third has the white tail of southern British *terrestris* and the yellow thoracic

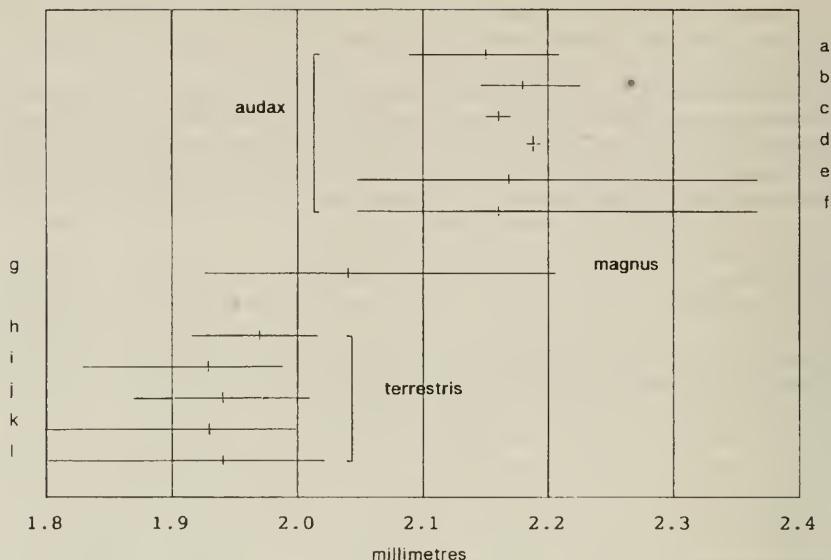


Fig. 1. Length of gonocoxite in *Bombus* (*Bombus*) species. a: *audax dalmatinus* D.T., Iran (Mazandaran) [includes one ex. det. Yarrow as *magnus* but which is normal *audax*] [$n=14$]. b: *audax virginialis* (Geoffr.), Channel Is. ($n=6$). c: *audax audax* (Harris), New Zealand [Nelson (Philpott): introduced] ($n=2$). d: *audax audax* (Harris), England (Surrey, Hindhead: atypical, hairs of face pale) ($n=2$). e: *audax* (Harris), England (south; Richards 1927: 249, as *terrestris*) ($n=49$). f: *audax* (Harris), all populations ($n=73$). g: *magnus* Vogt, Scotland (Sutherland, Inchnadamph) ($n=12$). h: *terrestris* (L.), Austria (Niederösterreich, Steiermark, Kärnten) ($n=11$). i: *terrestris* (L.), England (Norfolk, Mundford) ($n=3$). j: *terrestris* (L.), Iran (Mazandaran) [det. Yarrow as *magnus* (3) or *lucorum* (1)] ($n=4$). k: *terrestris* (L.), England (south; Richards 1927: 249, as *lucorum*) ($n=40$). l: *terrestris* (L.), all populations ($n=57$).

collar extending less far onto the mesepisterna. The collar in all three examples is paler than in *terrestris*.

Bombus (*Pyrobombus*) *jonellus jonellus* (Kirby 1802)

Apis jonella Kirby, 1802: 338; ♂; prope Londinum. Holotype ♂ BMNH designated by Yarrow (1968: 11).

Material: Sutherland, Inchnadamph: (A), 30.ix.1964, 2♂; 1.x.1964, 2♂; (B) 1.x.1964, 1♂; (C), 30.ix.1964, 3♂.

[Mull, Ross of Mull, Uisken, 10.ix.1963, 1♀ (C.H. Jowett).]

These examples are referable to f. *atrocorbiculosus* Vogt, 1911.

Psithyrus (*Ashtonipsithyrus*) *campestris* (Panz., 1800)

Apis campestris Panz., 1800, 7 (74): pl.11; [♀]; in regione sylvarum sabulosa [Germany].

Psithyrus (Allopsithyrus) barbutellus (Kirby, 1802)

Apis barbutella Kirby, 1802: 343; ♀♂; Barhamiæ.

Material: [Mull, Ross of Mull, Uisken, 2.ix.1962, at mallow, 2♂ (C.H. & P.H. Jowett).]

Psithyrus (Fernaldaepsithyrus) sylvestris Lepelletier, 1833

Psithyrus quadricolor 'sous-var. B.' *sylvestris* Lepelletier, 1833: 377; ♂; Les Pyrénées et les environs de Paris . . . de la collection de M. Latreille, actuellement en la possession de M. le général Dejean.

Apathus silvestris Thomson, 1872.

Material: Sutherland, Inchnadamph: ♂♂, white-tailed: (A), 1.x.1964, 1♂; 2.x.1964, 3♂; (B), 1.x.1964, 1♂ (somatic mosaic); Allt nan Uamh (NC 254178), 2.x.1964, 1♂ (f. *carelicus* Richards); ♂♂, yellow-tailed: (A) 29.ix.1964, 2♂; 30.ix.1964, 1♂ (f. *confinis* Franklin); 1.x.1964, 3♂; 2.x.1964, 2♂; ♀♀ (A), 30.ix.1964, 1♀; 2.x.1964, 2♀; Inchnadamph, n.f.d., 1♀.

A mixed population: the females are typical *sylvestris* as defined by Richards (1929: 353), the males a varied series of typical (white-tailed and *citrinus* (*Psithyrus quadricolor* var. *citrinus* Schmiedeknecht, 1883) (yellow-tailed) forms. The series varies also in the relative proportions of the basal flagellar segments, in the form and degree of development of the subapical callus of S7, and in the form of the squama. The callus of S7 varies from being broad, weak and regular to being narrow and more or less impressed medially, i.e. sub-bituberculate (regarded as the typical condition by, e.g., Popov, 1931, Richards, 1929). It was suspected initially that two species might be represented, *sylvestris* and *flavidus* (Eversmann, 1852) but there is no correlation between the observed variations. Some examples would, however, be difficult to separate from *flavidus*, a probable but insufficiently confirmed parasite of *B. jonellus*. In the palest male, A3 < 4; the hairs of the vertex are yellow and black mixed, of T1 yellow with a few black medially, of T2 and T3 medially black, of T3-5 yellow, of T6 (a few black medially) and T7 orange, and the callus of S7 is broad and regular: this comes very close to *flavidus* Eversmann.

The host of the Inchnadamph series is presumably *B. jonellus*.

Psithyrus (Fernaldaepsithyrus) meridionalis Richards, 1929

This species does not occur in Britain but the opportunity is taken of correcting errors in respect of the type locality. Richards (1929: 351) gave the type locality as 'Styria, Tragop Oberort', a misreading of Tragöb (Tragöss) Oberort (Austria, Steiermark, N.W. of Bruck an der Mur, at the foot of the Hochschwabgruppe). Løken, designating a lectotype (1984: 23), for some inexplicable reason transfers Styria to Yugoslavia.

SUMMARY

Species of *Bombus* and *Psithyrus* collected in Sutherland and on Mull and Iona are recorded. Notes on the nomenclature of the British forms of *Bombus laevis* Vogt, 1909, on the nomenclature of the species commonly known as *B. soroensis* (F., [1777]), and on the status of *B. magnus* Vogt, 1911, are given. The name *agricolae* is proposed for the Hebridean and Shetland form of *Bombus laevis* Vogt, hitherto known mistakenly as *smithianus* White or *liepetterseni* Løken. Lectotypes are

designated for *Bombus* 'Smithianus var., or race, *pallidus*' Evans, 1901 [= *B. muscorum celticus* Yarrow, 1978, = *B. laevis celticus* Yarrow] and *Bombus smithianus allenellus* Stelfox, 1933. Misstatements concerning the type locality of *Psithyrus meridionalis* Richards, 1929, are corrected.

ACKNOWLEDGEMENTS

For permission to collect on the Inchnadamph NNR in 1964 the author is indebted to English Nature (formerly the Nature Conservancy Council); for access to libraries, to the Librarian, Linnean Society of London (Miss G.L. Douglas), the Hope Librarian, University Museum, Oxford (Mrs. S. Newton) and the Librarians of the main and departmental libraries of the Natural History Museum, London (especially Mrs J. Harvey and Miss L. Mitchell); for the loan of, or access to, type material, to the Department of Natural History, National Museums of Scotland (Dr M.R. Shaw) and the Department of Entomology, the Natural History Museum, London (Mr T. Huddleston); and for information on Stelfox's type material, to the Natural History Division, National Museum of Ireland (Dr J. P. O'Connor).

NOTES

¹Vogt (1909:11) recognized four infrasubspecific categories: (a) *var. geographica*, equivalent to the modern concept of a subspecies; (b) *Rasse*, for forms of infrasubspecific rank (c.f. 1911: where the term is used for the colour-forms occurring within a single nest-colony); and (c) and (d), *aberratio* and *aberratio extrema*, for individual variations. In addition, he used *forma*, in an entirely modern sense, for forms of uncertain status (1911: 50, footnote 1). As the names *laevis* (1909: 63) and *magnus* (1911: 56) were proposed for *formae*, these names, as well as *sladeni* (proposed for a *forma geographica*, 1911: 52), are valid for subspecies attributed to Vogt.

²The use of the name *smithianus* for a Shetland insect represents a persistent misidentification. White (1852a: 158) proposed *smithianus* as a *nom. nov.* for *arcticus* Dahlbom, 1832, *nec arcticus* Kirby, 1821, as a result of Smith's having misidentified ['immediately recognized'] as *arcticus* Dahlbom specimens taken by White in various Shetland localities. Dahlbom's *arcticus* is a *pascuorum* subspecies of Arctic Fennoscandia: [*B. arcticus* Dahlbom, 1832, = *B. agrorum erlandssoni* Kruseman, 1950, =] *B. pascuorum smithianus* White, 1852.

Löken (1973: 114) treated *Apis arctica* Quen. in Acerbi, 1802, as a newly described species and as a senior synonym of *Bombus (Alpinobombus) hyperboreus* Schön. 1809, the latter name being retained and *arctica* considered a *nomen oblitum*. *Apis arctica*, however, appears *not* to have been intended as a new species: Acerbi (p. 250) stated 'The following are to be found in the work of Fabricius' and included in his listing (p. 252) the three species *Apis alpina*, *A. arctica*, and *A. lapponica*. *Apis arctica*, described by Quenzel on p. 253 and illustrated at fig. 7 on pl. I, should, therefore be some Fabrician insect, but whether of O. Fabricius or of J.C. Fabricius is unclear. While *Apis alpina* [*Apis alpina* L., 1758] does appear in the former's *Fauna Grönlandica* (1780) and *Apis lapponica* was described by the latter in the *Ent. Syst.* (1793), no *Apis arctica* appears to have been described in any work of either author published prior to 1802. It might be surmised therefore that one or the other Fabricius was in communication with either Acerbi or Quenzel and that *arctica* was a manuscript name given by him but not subsequently published (no *arctica* appears in J.C. Fabricius's

Syst. Piez. (1804)). *Apis arctica* appears, therefore, to have been published by accident rather than by design, but is nevertheless a validly proposed name.

³*Bombus laevis liepetterseni* [*Bombus muscorum liepetterseni* Løken, 1973] is erroneously included in the Aculeata section of the revised Check List (Fitton *et al.*, 1978: 140): *B. l. liepetterseni* is confined to Norway, where it occurs in coastal localities from 60° northwards. Presumably, the subspecies referred to was the hitherto in nominate, pale, form of *laevis* from the Hebrides and Shetland, i.e., *agricolae*.

⁴Not the only white-tailed form; cf. *cardui radoszkowskyi* Dalla Torre, 1890 (*Bombus perplexus* Radoszkowsky, 1884, *nec* Cresson, 1863). This subspecies was found to be one of the most abundant montane humble-bees in various localities in the Central Alborz (Iran), a single male taken at 1370m on 17.ix.1966, but all other specimens taken at between 2150 and 2450m, males from 24.viii to 7.x, females from 5.vii to 24.viii, workers from 27.vii to 7.x, many at *Salvia amasiaca* (Freyn & Bornm.) Bornm.

⁵*Bombus audax audax* is principally distinguished from other subspecies by having, in the female, a buff rather than a white tail, but buff-tailed examples do occur sporadically in continental *audax* [*virginalis* (Geoffroy, 1785)] (cf. Vogt, 1911: 39; H. Müller, 1944: 104) and the Sardinian *audax sassaricus* Tournier, 1890, is predominantly buff-tailed. Richards (1978: 417, as *terrestris terrestris*) notes that one Channel Is. (Alderney) female approaches the mainland British form.

⁶It is perhaps significant that in analysing geographical variation in '*Terrestris-bombus*' species, Krüger (1958: 294–303) did not attempt to differentiate between the males of *lucorum* (*terrestris*), *magnus* and *burjaeticus* (*burjaeticus* Krüger, 1951: 143, 1954: 277; from Transbaikal) in his tabulations. The recognition of numerous subspecies in *terrestris*, *audax* and *magnus* in the absence of fully adequate criteria for species recognition, and the recognition of supposed new species in the *terrestris* group, have been carried to extremes in some recent work.

⁷Caius Julius Agricola, whose fleet (first century A.D.) explored the north-east coast of Britain as far as the Orkneys.

REFERENCES

- Acerbi, J. 1802. *Travels through Sweden, Finland and Lapland, to the North Cape, in the years 1798 and 1799*, 2. Pp.[i]–viii, [1]–380, pl. London: J. Mawman [vide pl. facing p. 107. Løken erroneously gives Gillet as the publisher: Gillet was the printer]. The insects are contained in Section XV, "On the insects and testaceous animals of Lapland", pp. 245–256, pl. col. I–III.
- Baker, D. B. 1994. On the nomenclature of two sibling species of the *Andrena tibialis* (Kirby, 1802) group (Hymenoptera, Apoidea). *Entomologist's Gaz.* 45: 281–290.
- Bischoff, H. & Heddicke, H. 1931. Ueber einige von Illiger beschriebene Apiden (Hym.). *Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin* 1931: 385–392.
- Dahlbom, G. 1832. *Bombi Scandinaviae Monographice Tractati et lonibcus* [sic, for *Iconibus*] *Illustrati. Specimen Academicum quod, . . . subjicit G. Dahlbom . . . Respondente P.W. Brandsten . . .* Pp.[i], [1]–55, 1 pl. col. Londini Gothorum; Typis Berlingianis.
- Dalla Torre K. W. von. 1896. *Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus*, 10, *Apidae* (*Anthophila*). Pp.[iii], [i]–viii, [1]–643. Lipsiae; Guilelmi Engelmann.
- Day, M. C. 1979. The species of Hymenoptera described by Linnaeus in the genera *Sphex*, *Chrysis*, *Vespa*, *Apis* and *Mutilla*. *Biol. J. Linn. Soc.* 12: 45–84.
- Elfving, R. 1960. Die Hummeln und Schmarotzerhummeln Finnlands. *Fauna Fennica* 10: 1–43.
- Evans, W. 1901. The pale variety of *Bombus smithianus*, White, in Scotland. *Entomologist's Mon. Mag.* 37: 47.
- Fabricius, J. C. [1777] *Genera Insectorum eorumque characteres naturales secundum numerum, figuram, situm et proportionem omnium partium oris adiecta mantissa specierum nuper detectarum*. Pp.[i–xiv], 1–310. Chilonii; Litteris Mich. Friedr. Bartschii.

- Fabricius, J. C. 1787. *Mantissa insectorum sistens eorum species nuper detectas adiectis characteribus genericis, differentiis specificis, emendationibus, observationibus*, 1. Pp.xx + 348. Hafniae; Proft.
- Fabricius, J. C. 1793. *Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species adjectis synonymis, locis, observationibus, descriptionibus*, 2. Pp.viii + 519. Hafniae; Proft.
- Fabricius, J. C. 1804. *Systema insectorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*. Pp.;[i]–xiv, [15]–439, 1 [Errata], [1]–30 [Index alphabeticus], [1–2] [Verzeichniss]. Brunsvigae; Reichard.
- Fabricius, O. 1780. *Fauna Groenlandica, systematica sistens Animalia Groenlandiae occidentalis hactenus indagata, quoad nomen specificum, triviale, vernaculumque: synonyma auctorum plurium, descriptionem, locum, victum, generationem, mores, usum, capturamque singuli, prout detegendi occasio fuit, maximeque parte secundum proprias observationes Othonis Fabricii*. Pp.[i]–xvi, [1]–452, 1 pl. Hafniae & Lipsiae; impensis Ioannis Gottlob Rothe.
- Fitton, M.G., et al. 1978. A check list of British insects. Part 4: Hymenoptera. *Handb Ident. Br. Insects* **11**(4): [i]–ix, 1–159.
- Freuchen, P. & Salomonsen, F. 1959. *The Arctic year*. Pp.[i]–viii, [1]–440. London, Jonathan Cape.
- Friese, H. 1908. Ueber die Bienen (Apidae) der Russischen Polarexpedition 1900–1903 und einiger anderen arktischen Ausbeuten (Résultats scientifiques de l'Expédition Polaire Russe en 1900–1903, sous la direction du Baron E. Toll. Section E: Zoologie. Vol. I, Livr. 13.) *Mém Acad Impériale Sci. St-Petersbourg, VIII Série, Classe Physico-Mathématique*, **18**(13): [i–iii], [1]–17, [i–ii], pl. col. I.
- Kirby, W. 1802. *Monographia Apum Angliæ; or, an attempt to divide into their natural genera and families, such species of the Linnean genus Apis as have been discovered in England: with descriptions and observations*. Vol. 2, Pp.[i], [1]–388, pl. 15–18. Ipswich, J. Raw.
- Krüger, E. 1951–58. Phänoanalytische Studien an einigen Arten der Untergattung *Terrestri-bombus* O. Vogt (Hymen., Bomb.). *Tijdsch. Ent.* **93**: 141–197, fig. 1–22[1951] (Part I) **97**: 263–298, fig. 23[1954] (Part II); **99**: 75–105, fig. 24[1956] (Part II, Fortsetzung); **101**: 283–344, fig. 25[1958] (Part III).
- Lepelletier de Saint-Fargeau, Comte, A. 1833. Observations sur l'ouvrage intitulé «Bombi Scandinaviæ Monographicè Tractati, etc., à Gustav. Dahlbom. Londini Gothorum, 1832;» auxquelles on a joint les caractères des genres *Bombus* et *Psithyrus*, et la description des espèces qui appartiennent au dernier. *Ann Soc. Ent. France* **1**: 366–382.
- Løken, A. 1966. Notes on Fabrician species of *Bombus* Latr. and *Psithyrus* Lep., with designations of lectotypes (Hym., Apidae). *Entomologiske Meddelelser* **34**: 199–206.
- Løken, A. 1973. Studies on Scandinavian bumble bees (Hymenoptera, Apidae). *Norsk Ent. Tidssk.* **20**: [i–iv], [1]–218.
- Løken, A. 1984. Scandinavian species of the genus *Psithyrus* Lepelletier (Hymenoptera: Apidae). *Ent. Scand. Suppl.* **23**: [1]–45
- Mayr, E. 1969. *Principles of systematic Zoology*. Pp. [i]–xi [i], 1–428. New York, McGraw Hill.
- Müller, H. 1944. Beiträge zur Kenntnis der Bienenfauna Sachsens. (Hym. Apid.). *Mitt. Deutsch. Ent. Gesellsch. E. V.* **13**: 65–108
- Müller, O.F. 1776. *Zoologie Danicæ prodomus, seu animalium Danicæ et Norvegiæ indigenarum characteres, nomina, et synonyma imprimis popularium*. Pp. [I]–XXXII, [1]–274 [275–282, Addenda, not seen]. Havniae; Impensis Auctoris. [Preface[vii] dated 31 Mar. 1776, addenda (282) 18 Jun.1776]
- Panzer, G.W.F. 1792–1813, *Fauna Insectorum Germanicæ initia; oder Deutschlands Insecten gesammelt und herausgegeben von D. Georg Wolfgang Franz Panzer*, Part 74(1800), Nürnberg, Felssecker.
- Pittioni, B. 1939. Die Hummeln und Schmarotzerhummeln der Balkan-Halbinsel. II. Spezieller Teil. *Mitteilungen aus der königlichen naturwissenschaftlichen Instituten in Sofia* **12**. [49]–115, [116–121 = pl. 1–6], [122: Inhalts-Übersicht].
- Popov, V.V. 1930. Note on *Agrobombus smithianus* White (Hymenoptera, Bombidae). *Entomologicheskoye Obozrenie [Revue d'Entomologie de l'URSS]* **24**: 95–99.
- Popov, V.V. 1931. Zur Kenntnis der paläarktischen Schmarotzerhummeln (*Psithyrus* Lep.). *Eos, Madrid* **7**: 131–209.

- Richards, O.W. 1927. The specific characters of the British humblebees (Hymenoptera). *Trans. R. Ent. Soc. London* 75: 233–268, pl. XXII–XXV.
- Richards, O.W. 1929. A revision of the European bees allied to *Psithyrus quadricolor*, Lepeletier (Hymenoptera, Bombidae). *Trans. R. Ent. Soc. London* 76: 345–365, pl. XI.
- Richards, O.W. 1935a. *Bombus muscorum* (Linnaeus) and *B. smithianus* White (Hym.). *Trans., Soc. Br. Ent.* 2: 73–85.
- Richards, O.W. 1935b. Notes on the nomenclature of the Aculeate Hymenoptera, with special reference to British genera and species. *Trans. R. Ent. Soc. London* 83: 143–176.
- Richards, O.W. 1936. On a collection of humble-bees (*Bombus* and *Psithyrus*) from Cara Island, Argyllshire. *Entomologist's Mon. Mag.* 72: 109–111.
- Richards, O.W. 1978. The Hymenoptera Aculeata of the Channel Islands. *Rep. Trans. Soc. Guern.* 1978: 389–424.
- Saunders, E. 1884. Synopsis of British Hymenoptera. *Anthophila*; part II, Apidae. *Trans. Ent. Soc. London* 1884: 159–250, pl. V–VIII.
- Saunders, E. 1896. *The Hymenoptera Aculeata of the British Islands. A descriptive account of the families, genera, and species indigenous to Great Britain and Ireland, with notes as to habits, localities, habitats, etc.* Pp. [i]–xii, [1]–391, pl. 1, 1a, 1b, 2–52. London, L. Reeve & Co.
- Schmiedeknecht, O. 1930. *Die Hymenopteren Nord- und Mitteleuropas mit Einschluss von England, Südschweiz, Südtirol und Ungarn nach ihren Gattungen und zum grossen Teil auch nach ihren Arten analytisch bearbeitet.* 2nd ed. Pp. [i]–x, [1]–1062, frontisp., 127 fig. Jena, Gustav Fischer.
- Scopoli, J.A. 1763. *Entomologia Carniolica exhibens Insecta Carnioliae indigena et distributa in Ordines, Genera, Species, Varietates, Methodo Linnaeana.* Pp. [xxxvii], 1–420, [421: Notanda, Errata; 423: Monitum auctoris], 43 pl. Vindobonae, Trattner.
- Stelfox, A.W. 1933. On the occurrence of a peculiar race of the humble bee, *Bombus smithianus* White, on the Aran Islands, in Western Ireland. *Irish Nat. J.* 4: 235–238.
- Stelfox, A.W. 1934. *Bombus smithianus allenellus*: a correction. *Irish Nat. J.* 5: 42.
- Vogt, O. 1909. Studien über das Artproblem. Über das Variieren der Hummeln. I. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, Jahrgang 1909*: 28–84.
- Vogt, O. 1911. Studien über das Artproblem. Über das Variieren der Hummeln. II. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, Jahrgang 1911*: 31–74.
- White, A. 1852 (April). Note on the Natural History of Shetland. *Proc. Linn. Soc. London* 2(47): 157–158. [This note was reprinted, under the same title, setting unchanged, in October, 1852—*Ann. Mag. Nat. Hist.* (2) 10(58): 294.]
- Yarrow, I.H.H. 1968. Kirby's species of British bees: designation of holotypes and selection of lectotypes. Part I. Introduction and the species of *Apis* Linnaeus now included in the genera *Bombus* Latreille and *Psithyrus* Lepeletier. *Proc. R. Ent. Soc. London, Series B* 37: 9–15.
- Yarrow, I.H.H. 1978. Notes on British bumblebees. *Entomologist's Mon. Mag.* 113: 15–16.

APPENDIX 1. British and Irish forms of *Bombus laevis* Vogt

1. Pale, 'muscorum', forms [= *muscorum* Richards, 1935a, 1935b]

sladeni (Vogt, 1911): 52 [*Ab.* [*Agrobombus*] *muscorum* var. *geogr.*]; sex?; Südeingland'.

pallidus Evans, 1901: 47 ['*B. Smithianus*, var., or race, *pallidus*']; ♂; Scotland: 'taken by myself near Kingussie (Inverness-shire), Aberfoyle (S.W. Perthshire), and Elvanfoot (Lanarkshire), and also . . . from the Perth district, Dumbartonshire and Kirkcudbrightshire'. Invalid junior homonym of *Bombus pallidus* Cresson, 1863 [= *Bombus (Fervidobombus) pennsylvanicus* (Degeer, 1773)]. No type designated by Evans: for lectotype designation see p. 8.

celticus Yarrow, 1978: 15 [*Bombus muscorum celticus*]; *nom. nov.* for '*Bombus muscorum pallidus* Evans (*Bombus smithianus* var. *pallidus* Evans, 1901)'. Yarrow failed to designate a lectotype for *pallidus*.

Distribution: Mainland Britain and Ireland; Mull; Skye.

orcadensis Richards, 1935a: 78 [*Bombus muscorum orcadensis*]; ♀, 'The male and worker are not distinguishable from *pallidus*'; Orkney Is: Holotype ♀ (examined), labelled 'Orkney Is. [print], Mainland, Stennes. 15.vi.12 [MS], E.G.B. Meade-Waldo. 1912-259. [print]' and '*B. muscorum orcadensis* Rich. Type' [pencil, Richards], in BMNH [not registered].

Distribution: Orkney Is.

2. Dark, '*smithianus*', forms [= *smithianus* Richards, 1935a]

agricolae⁷ subsp. nov.

[*smithianus* *auct.*, *nec* White, 1852; misidentification.]

[*smithianus smithianus* Richards, 1935a; misidentification.]

[*liepeterseni* Fitton *et al.* (1978) *nec* Løken, 1973; misidentification.]

muscorum zelandicus Yarrow, MS, in BMNH.

Description; see Richards, 1935a: 79 [as *smithianus smithianus*]; ♀♂; Shetlands, Lewis, Tiree, Coll.

Holotype: ♀ labelled '51₉₁' [the entry 1851-91 in the British Museum's accessions register, referring to this one specimen, reads '*Bombus arcticus* . . . Lerwick . . . Presented by A. White Esq^{re} . . . the common *Bombus* of the Mainland of Shetland'], 'var. *smithianus* White. [print]', and '*B. muscorum zelandicus* ssp. n. det. I.H.H. Yarrow HOLOTYPE ♀', B.M. Type Hym. 17 b 1276.

Distribution: Inner and Outer Hebrides; Shetland; ? Ross [the Ross specimen recorded by Richards may simply have been a dark example in a *sladeni* population].

Yarrow's manuscript name is not adopted since the species has a wider distribution than the name implies. It is however given here since it may be encountered in other collections.

allenellus Stelfox, 1933: 235 [*Bombus smithianus allenellus*]; ♂♀; Ireland: Aran Is., Inishmore. Stelfox, 1934: 42.

Stelfox's type series comprised 50 specimens, all bearing the National Museum of Ireland's printed label 'Inishmore/Aran Islands/Co. Galway./C. W. Allen. July 1932./62-1932.', standing over his manuscript label '*Bombus Smithianus* White, race *allenellus* Stelfox. 50 typical series arranged by A.W.S. 17.2. 1934. Described in I.N.J. Nov. 1933. A. W. Stelfox.'. Stelfox did not designate a type but labelled one ♀ as 'type', one ♂ and one ♀ as 'cotypes' (Dr J. P. O'Connor, personal communication). Stelfox's ♀ 'type' is now designated as lectotype of *allenellus*, his other syntypes as paralectotypes.

Distribution: Aran Is.

scyllonius Richards, 1935a: 81 [*smithianus scyllonius*]; holotype ♀ Scilly Is.: St. Mary's, 10.ix.1904 ([Col. J.W.] Yerbury), B.M. Type Hym. 17 b 1214.

smithianus subsp. *innom.*, Richards, 1935a: 81 (Channel Is.: Alderney).

Distribution: Scilly Is.: Channel Is. (Richards, 1978: 419—Channel Is. form no longer regarded as subspecifically distinct from Scillies form).